REMARKS

Reconsideration and allowance in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 4-14 remain pending.

Applicant notes with appreciation the Examiner's indication that claims 4-6, 10 and 12 are allowed. Claims 4, 5, and 13 have been amended above to insert the term --substantially-- before "isoentropic". In this regard, on review it was believed more appropriate to say that such flow is "substantially" isoentropic because it is recognized that some loss of energy will always occur in the flow, albeit small/smaller according to the invention. No new matter has been added.

Claim 7 has been amended to correct the antecedent basis matter noted by the Examiner. In view of the foregoing, it is respectfully submitted that the Examiner's rejection under 35 USC 112, second paragraph, has been overcome and that the claims 7-9 should now be allowed.

Claims 8, 11, 13 and 14 were rejected under 35 USC 112, first paragraph, as containing subject matter which was allegedly not described in the specification in such a way as to convey to the skilled artisan that the inventor's had possession of the claimed invention at the time the application was filed. Reconsideration is respectfully requested. With regard to the Examiner's objection with respect to claims 8, 11 and 14, it is respectfully noted that applicant's invention is disclosed as an improvement in the gas lift valve which renders it more effective. The invention relates in particular to an improvement to the seat of this kind of valve (Summary of invention, line 1); and the invention provides in particular a new geometry for the seat of this kind of valve.

Bearing the foregoing in mind, the skilled artisan will immediately recognize that the invention relates to an improved gas lift valve. It is respectfully submitted that a

check valve as described and illustrated in Figure 1 is well understood by the skilled artisan to be incorporated in a gas lift valve. Thus, in a gas lift system embodying the invention, as recited in, e.g., in claim 7, it is quite appropriate to provide for and specify the inclusion of a check valve.

The fact that applicant's invention relates in particular to an improved seat for this kind of valve does not preclude applicants from properly claiming that the gas lift system incorporating the improved seat of the invention also includes a check valve. It is further respectfully submitted that there is nothing improper in respect to applicant's inclusion of a check valve in the system claimed as a dependent claim. In this regard, the combination recited in claim 7 includes the novel seat of the invention and several additional components. There is no requirement that every single component recited in claim 7 or in the claims dependent therefrom each be *per se* novel. In other words, neither 35 USC 112, first paragraph, nor any other paragraph of Section 112 precludes applicant from claiming in a dependent claim an additional component or characteristic that is *per se* known as long as the combination claimed by applicant is novel and unobvious. In this case it is respectfully submitted that the combination of each of applicants independent claims is novel and non-obvious from the prior art of record even though the provision of a check valve is known and check valves are conventionally provided as a part of a gas lift system.

As noted by the Examiner and as described with reference to Figure 1, it is known to include a check valve in a gas lift system and for that reason a system embodying the invention preferably includes a check valve too.

Enclosed for the Examiners' information and reference is a copy of relevant pages of volume 1 of the book "Petroleum Production Handbook" from Thomas C. Frick and R. William Taylor, Published by McGraw-Hill Book Company, Inc. in 1962. At page 5-6 of this book, in the section regarding check valves in gas lift valve, it is mentioned that "although the main valves can be purchased without [the check valves], their

function is important enough that they should be considered an integral part of the valve system". (emphasis added.)

The above-mentioned passage makes it quite clear that the skilled artisan would consider a check valve to be an appropriate part of a gas lift valve. Further note in this regard that Figures 5.8, 5.9, 5.11 and 5.12 depict gas lift valves provided with check valves.

Furthermore, enclosed is a copy of U.S. Patent No. 5,066,198. This patent relates to a gas lift valve for controlling fluid flow between the exterior and the interior of a well tubing. Actually, the invention is an unloading or kick-off gas lift valve used in a continuous gas lift installation.

The Examiner's attention is directed in particular to Figures 3C and 4C, where a check valve 160 is shown as part of the gas lift valve. Also the passage at column 8, lines 7-8, where it is mentioned that "the purpose of the check valve [160] is to prevent the flow of fluids from the tubing to the annulus."

Moreover, notice that in Figure 9 an operating gas lift valve 600 is depicted. This valve is used to inject gas during operation of the well. Gas lift valve 600 is an orifice valve and is characterized as a prior art gas lift valve. Notice that gas lift valve 600 is provided with a check valve 640. At column 13, lines 35-63, gas lift valve 600 is described. Notice the passage staring at line 57 where it is mentioned that "The check valve [640] obviously permits fluid flow from casing to tubing but will not allow flow from tubing to casing"; and the passage starting at line 60, where it is mentioned that "Device 600 [orifice gas lift valve] simply provides an orifice or choke for metering the flow of lift gas entering the tubing and a check valve for preventing tubing contents from flowing into the casing". From these passages, it is quite clear that the gas lift valve is a device that would be understood and would conventionally comprise, among other things, a choke and a check valve. Thus, the skilled artisan would understand from applicant's disclosure not only that a check valve is a component part of prior art

system of Figure 1, but it would also be appropriately included as a part of a gas lift valve provided according to the invention, incorporating applicant's novel gas valve seat. Thus, the check valve is a component part of the gas lift valve with an important roll to play during operation.

By reading the above-noted passages it is quite clear that anyone skilled in the art would recognize that a gas valve embodying the invention could and desirably should be provided with a check valve. Indeed, it is quite clear that the gas lift valve of the invention would be a part of a greater system including a variety of component parts, many of which are known, *per se*, the novelty residing in accordance with the invention with the venturi of the invention replacing the conventional rounded orifice of the prior art.

With reference to claim 13, at the outset, it is noted that claim 13 has been revised to delete the phrase "density less than the density of reservoir fluids into the annulus". In this regard, it is recognized that this passage may be misinterpreted to require that the compressed gas must be of a density less than all fluids coming from the reservoir, whereas it is recognized that there are situations in which fluid from the reservoir may comprise gas which is less dense than the injection gas. Therefore, this passage has simply been eliminated. In regard to the more generally recited step of flowing the compressed gas into the annulus and the step of mixing gas injected from the outlet portion of the gas lift valve with reservoir fluids in the tubing, once again the Examiner's attention is respectfully directed to U.S. Patent No. 5,066,198 for further background information regarding the conventional gas lifting method. Of course applicant's recitation is directed to the skilled artisan who would be well familiar with conventional gas lift valve structures and gas lifting methods.

At column 1, lines 14-20 of the '198 patent, it is mentioned that "...such valves [gas lift valves] commonly control the admission of lift gas into the well tubing from the well casing to aid in lifting formation liquids to the surface. Lift gas is generally injected into the well casing at the surface". Also enclosed are copies of relevant pages of the

book "GAS LIFT – BOOK 6 OF THE VOCATIONAL TRAINING SERIES", published in 1984 by the American Petroleum Institute. Note that at the beginning of chapter 6 the steps of injecting gas from the surface and of mingling such injected gas with fluids coming from a reservoir are mentioned. Finally, enclosed are copies of relevant pages of the book "THE TECHNOLOGY OF ARTIFICIAL GAS LIFT METHODS", by Kermit E. Brown, published by Petroleum Publishing Company, Tulsa, Oklahoma, in 1980, which describes the gas lifting method. The Examiner's attention is directed in particular to the passage starting at the first line of the first paragraph of page 96 and ending at the last line of the paragraph. Also notice the passage at the start of the first line of the fifth paragraph of page 96 and ending at the last line of that paragraph. In these two passages, the basic steps of a gas lift method are described.

The skilled artisan, by reading applicant's specification would immediately recognize that the inventive gas lift valve can be used to practice the conventional gas lifting method in order to enhance lifting results, as described in the specification. Moreover, as the steps which should be followed for lifting fluids are the same whether using the prior art gas lift valve or the inventive gas lift valve, it is noted that the fundamental difference in both cases resides in the result obtained wherein the method is practiced using the inventive gas lift valve as recited in claim 13, which is new. In other words, the invention of method claim 13 resides in the use of the novel gas lift valve, which causes the effects that are clearly described in the specification. The steps to follow for lifting fluids using injecting gas are basically the same and well known in the art. For that reason, a detailed recounting in the specification is unnecessary for the skilled artisan to appreciate and understand the method of the invention. Moreover, the novelty resides in the effects reached by such use; the acceleration and slowing down of gas according to the configuration of the orifice of the invention produces the novel effects of the invention.

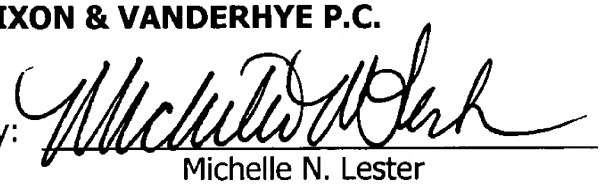
In view of the foregoing, reconsideration and withdrawal of the Examiner's objections to claim 8, 11, 13 and 14 are requested.

Claims 7-9 were rejected under 35 USC 112, second paragraph. As mentioned above, claim 7 has been amended to obviate the grounds for this rejection. Reconsideration and withdrawal of this rejection are requested.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please substitute the following amended claim(s) for corresponding claim(s) previously presented. A copy of the amended claim(s) showing current revisions is attached.

4. (Amended) In an oil well having a casing with tubing concentrically disposed therein, an apparatus for controlling gas lift, said apparatus comprising a gas lift valve mounted on said tubing and having an inlet end in communication with a space between said tubing and said casing and an outlet in communication with an interior of said tubing, said gas lift valve consisting of a housing and a nozzle mounted in said housing, said nozzle having a continuously open passage through which gas is allowed to flow, wherein said passage consists of a curved inlet portion through which gas flow is speeded up, a smooth straight, intermediate portion providing a main restriction to gas flow and a smooth, outwardly tapered, conical shaped outlet portion through which said gas flow is gradually slowed down, reducing the gas pressure loss and rendering gas flow substantially isoentropic.

5. (Amended) In an oil well having a casing and a tubing with an annulus defined therebetween, an apparatus for controlling the flow of gas from said annulus into said tubing, said apparatus comprising:

a gas lift valve mounted on said tubing and having an inlet end in communication with said annulus for admitting gas from said annulus into said gas lift valve, and an outlet end in communication with an interior of said tubing, for discharging gas into said tubing;

said gas lift valve including a housing and a nozzle mounted in said housing, said nozzle being provided with a continuously open passage through which gas is allowed to flow, said passage comprising:

a convergent inlet portion through which gas flow is gradually accelerated, and

a divergent outlet portion through which said gas flow is gradually slowed down, thereby reducing the gas pressure loss and rendering the gas flow substantially isoentropic.

7. (Amended) In a gas lift system for injecting pressurized gas into a well having a production string, a gas flow control valve comprising:

a housing including at least one inlet port and at least one outlet port;

an orifice comprising a nozzle portion and a diffuser portion;

said nozzle portion including a nozzle first end, a nozzle second end, and a nozzle flow path between said nozzle first end and said nozzle second end; said nozzle flow path converging from said nozzle first end to said nozzle second end, such that the gas experiences a decrease in pressure;

said diffuser portion including a diffuser first end and a diffuser second end, and a diffuser flow path therebetween,

said diffuser flow path diverging from said diffuser first end to said diffuser second end, such that the gas experiences a rise in pressure, said diffuser first end being disposed adjacent said nozzle second end, such that a throat is defined therebetween, said diffuser flow path being aligned with said nozzle flow path to provide a continuous flow path;

whereby pressurized gas can flow into said at least one inlet port of said gas flow control valve through said continuous flow path, and out through said at least one outlet port into a production string.

13. (Amended) A method for achieving flow through a flow control valve in a well having a tubing concentrically spaced within a casing by an annulus, comprising the steps of:

placing a gas lift valve within the well, at a predetermined location, said gas lift valve having an inlet end in communication with said annulus, and an outlet end in communication with an interior of said tubing;

flowing compressed gas [of density less than a density of reservoir fluids] into the annulus;

flowing the compressed gas from the annulus into a convergent nozzle portion of the gas lift valve;

gradually accelerating gas flow through said nozzle portion;

gradually slowing down said gas flow in a divergent outlet portion of the gas lift valve, thereby reducing the gas pressure loss and rendering the gas flow substantially isoentropic; and

mixing gas ejected from the outlet portion of the gas lift valve with reservoir fluids in the tubing.